DNA Extraction

Background

Cells are the basic units of life that make up all plants, animals, fungi, and bacteria. All forms of life possess genetic material that is passed from one generation to the next that provides important information unique to the species. Deoxyribonucleic acid, or DNA, is the genetic material that regulates everything that happens within the cell. DNA contains instructions that direct the activity of the cell, the construction of proteins and, ultimately, the entire organism. This activity will demonstrate how DNA can be isolated using simple, common household materials.

In this activity, the organism that DNA will be extracted from is a strawberry. Strawberries work well because they have enormous amounts of DNA. For some perspective, humans have two copies of each chromosome – a diploid genome (46 chromosomes total). Strawberries, on the other hand, are octoploid. This means that each cell has eight copies of each chromosome (56 chromosomes total)!

Objective(s)

- ✓ to utilize a simple DNA extraction method
- ✓ to visualize a large sample of DNA

Materials

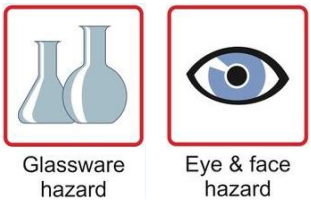
- strawberry
- plastic bag
- 250 mL flask
- 50 mL graduated cylinder
- 10 mL graduated cylinder (x2)
- 50 mL water
- 5 mL liquid detergent
- 3 g salt
- weigh boat
- funnel
- coffee filter
- 5 mL ice-cold isopropyl alcohol
- wooden stick
- electronic balance

Pre-Lab Questions

Answer the following questions below on a separate sheet of paper. For actual questions, you must either write out the questions, or include the questions in your responses. Be sure to use complete sentences.

1. If strawberries are octoploid, and they have a total of 56 chromosomes, how many **different** chromosomes must strawberries have? Explain how you arrived at your answer.
2. Where is the DNA contained within eukaryotic cells?

Safety



Procedure

1. Pull off any green leaves on the strawberry, if present.
2. Put the strawberry into the plastic bag and seal it closed. Gently, but thoroughly, smash up the strawberry for 2 – 3 minutes. This will break it apart and begin to break open the cells and release their contents.

3. To prepare the DNA extraction liquid, combine the following ingredients into the flask:
    a. Use the large graduated cylinder to measure and pour 50 mL of water
    b. Use one of the small graduated cylinders to measure and pour 5 mL of liquid detergent
    c. Use the weigh boat and an electronic balance to mass 3 g of salt
    d. Swirl the flask until the ingredients are completely mixed, but **avoid making bubbles**
4. Use the **same small graduated cylinder** to measure out 10 mL of the properly mixed extraction liquid and pour it into the bag with the smashed-up strawberry. The liquid will assist in breaking up the cells further and breaking open the cells' nuclei to release the DNA.
5. Reseal the bag and mix/smash the contents for another 2 – 3 minutes. It is important to **avoid making bubbles** as much as possible.
6. Place a coffee filter into a funnel and funnel into the large graduated cylinder.
7. Open the bag and carefully pour out its contents into the funnel. Don't pour more quickly than the coffee filter and funnel can drain.
8. Use the second graduated cylinder to measure about 5 mL of ice-cold isopropyl alcohol and SLOWLY pour the alcohol down the side of the large graduated cylinder. It is crucial to pour slowly so that the alcohol forms a separate layer on top of the strawberry liquid.
9. Allow the large graduated cylinder to sit for a minute of two until a cloudy white substance becomes visible at the layer where the strawberry liquid and alcohol meet. (Note: The substance may be pinkish in in color. DNA does not have any color – it's the strawberry's natural pigment producing the color.)
10. Carefully insert the wooden stick into the thin layer between the strawberry liquid and the alcohol and slowly twirl it to collect the DNA. You may need to gently "push" the alcohol layer into the strawberry layer a bit to collect a sample of the DNA.
11. Slowly pull the stick out of the graduated cylinder and observe the DNA!

Clean Up

- ✓ trash: plastic bag, strawberry chunks, coffee filter, wooden stick
- ✓ sink: DNA extraction liquid, contents of large graduated cylinder
- ✓ rinse (no need to dry): flask, graduated cylinders, funnel
- ✓ everything else returned to its original location